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THE CAUSES OF EXUDATION IN INFLAMMATION.

BY MR. EDWARD GREELY LORING, JR. AN ESSAY TO WHICH ONE OF THE PRIZES OF
THE BOYLSTON MEDICAL SOCIETY WAS AWARDED.*

[Communicated for the Boston Medical and Surgical Journal.]

THE object of the following Essay is to prove how far in an inflammatory process the exudation is the result of the inflammation, not a part of it, and how far it is dependent on the saline ingredients of the economy.

The following statements were taken from one of Dr. White's lectures at the Hospital on the clinical examination of the urine. "The chloride of sodium has a great effect in rendering substances in the blood soluble. Blood contains in every 1000 parts 4.2 parts of chloride of sodium, serum 4.6. Effusion in pleurisy, 7.5. Ten and one half grammes pass out of the system by the kidneys in twenty-four hours. In acute diseases, where there is effusion into serous cavities, joints or tissues, the chlorides are diminished in the urine. In pneumonia the chlorides are very much and very rapidly diminished—sometimes totally in twenty-four hours. When reabsorption takes place, the chlorides reappear in the urine. In inflammation of the liver, in peritonitis, and in cholera, there is often a total absence of the chlorides in the urine. If the chlorides reappear, convalescence takes place. In typhoid fever the chlorides are diminished, though not so much, nor so rapidly, as in the above-mentioned diseases. In intermittent fever they are diminished on the fever day. The urine only contains the surplus of what is not wanted by the blood. The kidneys refuse to eliminate the chlorides where there is inflammation with effusion. If, when the kidneys will not eliminate it, salt be passed in quantities into the system, it will then be eliminated through the intestinal canal, but not until the blood is saturated. When the chlorides are diminished in the urine, the other saline ingredients are also diminished, though in a less degree. In rheumatism the chlorides in the urine are but slightly di-

* A prize awarded to under-graduates of Harvard Medical School.

minished, though when pericarditis is associated with it, they are diminished to a considerable extent."

It will be seen by the above statements, that, in all diseases characterized by an exudation, the chlorides (the chief of which by far is the chloride of sodium) are diminished in the urine, and, that the more inflammatory the disease is, the greater is the decrease, and that as they decrease in the urine, so they increase in the exudation, since the serum of the blood contains but 4-6 parts in 1000, while the effusion resulting from an inflammatory disease, where the chlorides are diminished in the urine, contains 7-5 parts. Now as the diminution of the chlorides in the urine is accompanied by their increase in the exudation, and, as exudation is often the result of inflammation, the question arises, what relation their disappearance in one place bears to their appearance in another, and to what extent, if any, does their diminution on the one hand, and their increase on the other, affect the process of inflammation, or at least that part of it which relates to effusion?

Without stopping to speculate on the vexed question of what inflammation is, or what its causes are, let us look at some of its effects after the process is once set in motion—the two most prominent of which effects are determination with increased flow of blood towards a certain spot, followed by a stagnation of blood and an exudation at that spot.

The exudation is the result of endosmosis and exosmosis. Certain laws govern this process, among which are the following:—

1. A non-saline or watery fluid will pass through a membrane towards a saline one, faster than the saline one will pass to it, and the rapidity with which the watery fluid will pass to the saline is in proportion to their different consistency.
2. The quicker the current of a liquid on one side of a membrane, the greater the attraction, and, consequently, the greater the endosmosis into that liquid.
3. The activity of endosmosis and exosmosis is in direct proportion to the extent of surface over which the two liquids come in contact with the intervening membrane.
4. Pressure exerted on fluids favors their passage through a membrane.
5. Affinity and the desire which a fluid has to maintain its integrity favors the process of endosmosis.

In inflammation there is a great increase in the metamorphosis of tissue and an increased flow of blood to the part for the purpose of repairing in some way the waste, occasioned by the process which we call inflammation. Now the greater the inflammation, the more the waste, and the greater the determination of blood to repair that waste. The process by which tissues are repaired is the same as that by which they are nourished, in disease as in health, viz., that of transudation, known as the process of endosmosis and exosmosis. It is

sometimes thought that the exudation which characterizes inflammation is due to the fact that the blood, in passing through the inflamed portion, gives up its watery parts, and then in its altered condition passes on, while its place is supplied by fresh blood, which, in its turn, undergoes the same process. Now if this were true, the more rapid the current of the blood the greater the exudation, which is diametrically opposed to the law proved by Matteucci, that the force of transudation was *into* the current, not *from* it, and that this force was in proportion to its rapidity. Again, if this were the case, the greatest amount of exudation would be at the highest point of the inflammation. But every practising physician knows that the force of the inflammation and the rapidity of the current begin to subside as the exudation appears. This is not only true chemically, but is also in accordance with physical laws. Henle says: "As a physical consequence of the dilatation of the vessels, there takes place a retarded flow of the blood. This, together with the relaxation and dilatation of the vessels, favors the exudation of the serum, the consequence of which is that the plasma of the blood becomes inspissated by a preponderance of the protein matters over the salts." This is quoted here simply to prove that the flow is retarded, not to answer the question what occasions the "stasis," which, according to Mr. C. Hanfield Jones, "is the great unsolved problem of inflammation." But more of this hereafter.

Taking into consideration all the above facts and laws, rational and physical, let us boldly put forth the theory that the exudation is the result of inflammation, not a part of it; and that it is dependent on the saline ingredients of the economy, "of which the chloride of sodium is rather more abundant in the blood than all the rest together," and then let us see how far our premises will support our conclusions.

Suppose active inflammation to exist, and with it, as a matter of course, an increase in the metamorphosis of the tissue, and that with this we also have an increased flow of blood towards the spot, caused, it is fair to suppose, by the thirst which the tissue has to repair the waste occasioned by the morbid action. This, it is true, is theoretical, but as long as the cause or causes of inflammation are enveloped in mystery, we have a right to indulge in a theory which is based on common sense, till a fact demonstrates it to be untrue. Is it not fair to suppose that the sensation which we call hunger, and that which we call thirst, are but the expression of the desire which the tissues have for that wherewith to replace what has been expended? Cannot inflammation be supposed to bear the same relation to the natural process of nutrition that a morbid craving does to a natural appetite? In support of this theory, Mr. Simon, in his "Lectures on Pathology," remarks, "altogether, we may take it as an established certainty, that the first change which occurs in an inflamed or *overgrowing* part, and which leads to its becoming loaded

with blood, is not a reflex change operated through the nerves, but is a direct change by the living molecular structure of the part on the blood which traverses it, or on the vessels which convey the blood." It is to be remembered that the increased and more rapid flow of the blood through the vessels are things which, by the aid of the microscope, we can see—but the molecular movements of nutrition and secretion, which we believe to influence and modify the circulation through a part, we cannot see. They are, however, as real, as potent; but they are, except in their results, invisible.

Suppose, then, this active metamorphosis to be going on, and a very much larger amount of nutritive material to be consumed than that required in an ordinary state of health, might it not be possible, nay probable, of a plasma composed of watery, organic and inorganic compounds, that the liquid and easily decomposable organic matter should be more rapidly consumed than the inorganic or saline material, and in this manner might there not result an accumulation of the latter in the surrounding tissues and membranes? Or, even stronger, might not the tissues, influenced by the morbid action, have a direct desire for particular ingredients of the blood over the others, in which case we should expect to find a diminished amount of this particular ingredient in the blood, when affected by the inflammatory action, than when in a state of health? Now, according to Jones and Sieveking, "in violent inflammation the salts are much diminished," and according to Henle, through exudation of the watery and saline parts, the plasma of the blood becomes inspissated by a preponderance of protein matter over the salts.

In the blood we have seen that the chloride of sodium is more abundant than all the other saline ingredients put together, and we should naturally suppose, even had it not been proved, that its abstraction from the blood would be followed by grave results.

In case of inflammation with exudation, the "kidneys do not eliminate the chlorides." What becomes, then, of all the chlorides introduced into the system, especially the chloride of sodium, which is largely taken into the economy with whatever we eat, drink or breathe? As the kidneys do not eliminate it, we should expect to find the blood charged with it; but in inflammation the blood contains less than in health, when the kidneys are actively drawing it from the blood. If the kidneys do not eliminate, and the blood contains less than its normal amount, what becomes of it? The excess must exist somewhere, and it does exist in the exudation, where it is found in the proportion of 7.5 to 4.6 parts in 1000 of the healthy serum of the blood. But it is proved that when the kidneys refuse to eliminate the chlorides, they are eliminated by the intestinal canal; but this only happens, according to Dr. White, when the blood is saturated with them, and as in inflammation the blood is not only not saturated, but even contains less than its usual amount, this elimination cannot take place.

We have supposed above that an inflammation existed, that there was an increased flow of blood towards a particular spot, that there was an increased metamorphosis of tissue, that there was an accumulation of the saline ingredients in the neighboring tissue. To support this last statement, which it is our object to prove, we have the following facts:—

1. Absence of the chlorides from the urine.
2. Decrease of them in the blood.
3. Increase of them in the exudation.

Let us now see how this increase in the exudation takes place, and to what it is owing.

To do this we must recapitulate, and imagine, as before, that the inflammatory process has been set in motion. The blood now rushes towards the inflamed part, forcibly drawn thither by the desire which the tissues have to supply the waste by new material. Arrived at the spot, it delivers to the tissues what they need. But the desire being greater than the supply can satisfy, fresh blood is attracted to the spot, and, this process continuing, a current is established, and the greater the desire, or, in other words, the greater the inflammation, the quicker the current. But it has been stated that the quicker the current is, the less the exosmosis, and, consequently, the less the material passed to the tissues. This would be true were it not for the fact, that it is the affinity which the tissues on one side of the membrane have for what the blood contains on the other that causes the current; and it is easy to see that attraction towards a particular spot might cause a current towards that spot, with transudation *outward at that spot*, while in other places where the morbid action did not exist, the attraction would be *into* the current and in proportion to its rapidity. So it is with inflammation. What it furnishes to one place it abstracts from another, and so drains the system.

Therefore, suppose the circulation, and at the same time the transudation of the plasma to be rapid—since we have seen that these two conditions are not necessarily incompatible—a great amount of new material is then rapidly delivered to the tissues and is as rapidly consumed, and the consumption of the protein compounds being greater than that of the saline from their very nature, it follows that the neighboring tissues will become incorporated with the salts, and this consumption of the organic and accumulation of the inorganic will go on as long as the morbid action lasts. But when this desire on the part of the tissues ceases, a new condition of affairs takes place. The rapidity of the current, which had been occasioned by the “attraction,” diminishes as its cause becomes less, and the current would again regain its natural velocity, were it not that a new set of phenomena, purely physical, now occur. The condition is this:—Suppose the walls of the capillaries to represent, as they do, a membrane through which the process of endosmosis and exosmosis takes

place. On one side of the membrane is the tissue incorporated with the salts, or a saline liquid, while on the other is the blood, or a watery liquid, and more so than usual, for, as Lehmann states, "in the beginning of most diseases, especially the acute ones, the blood is found more watery than usual." Now what takes place? In obedience to the law, the watery fluid passes to the saline, and the amount and velocity with which the former will pass to the latter are in proportion to the amount and density of the latter. What is the result? Exudation or infiltration on the one side, while the blood on the other, deprived of its watery and saline ingredients—the latter of which, according to Dalton, play so important a part in rendering the albumen soluble and maintaining the integrity of the globules—becomes thick and inspissated, and, the protein material predominating over the watery and saline, the fluid, from its very nature, becomes unfit for circulation, and stasis occurs; and the inflammatory action continuing, disintegration of the vessels and tissues follows. Cannot this *questio vexata*, this matter of stasis, which so many anatomists have tried so hard to prove was the result of some invisible, vital force, be explained as the simple result of the above physical laws and their actions?

In speaking of this matter of stasis, Mr. Wharton Jones says:—"The stagnation commences in the capillaries, and extends from them to the veins on the one hand and the arteries on the other;" and Mr. Hanfield Jones, writing on the same subject, says:—"We have seen the blood stagnant in the capillaries, while it was moving on steadily through an adjacent artery and vein. This points to the capillaries as the part where the arrest commences," and this is precisely where the exosmosis takes place.

We now have, as the result of the inflammatory action, a stoppage of the circulation at the spot and a thickened and altered blood, which the *vis a tergo* is unable to force through the vessels, on one side of the walls of the capillaries, the effusion on the other. With this we also have decrease of saline compounds in the blood—especially the chloride of sodium—and decrease and even absence of the chlorides in the urine. If the inflammatory action continues, the tissues will undergo further changes until degeneration of them and the surrounding parts ensues. But if the morbid process ceases, a different result follows. Strictly speaking, there can be but one end to inflammation—that which is called resolution, in which the diseased action ceases to advance, and then recedes by the same steps by which it arrived at the condition of stasis. The inflammatory process ceasing, the "craving" which the tissues had ceased also, and the attraction no longer existing, the desire on the part of the blood to regain its former consistency and to maintain its integrity causes the transudation to be into the capillaries, not from them, in conformity with, if not in obedience to the physical law that the lighter liquid passes to the heavier in proportion to the density

of the latter, the affinity between the two liquids being in proportion to their difference. The force of the *vis a tergo* is now sufficient to propel the fluid through the capillaries, and circulation is re-established. These phenomena correspond to the subsidence of the general symptoms.

The redness and the pain become less, the temperature is lowered, and the swelling (caused, according to Rokitsansky, not by the congestion of the vessels, but by the effusion) subsides. This is resolution, or reabsorption. But it is not water alone that the blood stands in need of; it wants also the salts which have been exhausted from it, to render its protein compounds soluble and to maintain the integrity of its globules. So as reabsorption takes place, not only does the blood regain its normal amount of saline ingredients, but these also *reappear in the urine*, in which they were either diminished or totally absent.

Now as we have seen, while the inflammatory action is at its height, there is a minimum of the saline ingredients of the blood, a minimum or absence of them in the urine, and a maximum in the effusion; and as the effusion disappears so do they reappear both in the blood and in the urine, it is fair to conclude, then, that the increased quantity in the effusion was obtained at the expense of that which previously existed in the blood and of that which would have been eliminated by the kidneys. This would follow rationally, had it not been *proved* by actual analysis that the effusion did contain more saline material than the serum of the blood from which the effusion is elaborated.

Taking all the above facts into consideration, we may at least have some reason for thinking that the exudation is not a part of the inflammatory process, but is rather the result of the morbid action depending on or occasioned by the saline ingredients of the blood, of which the chlorides play by far the most important part, and that the effusion is rather a physical than a vital process. Let us see, now, if this view will conform with the phenomena presented by actual disease.

We will begin with pleurisy. We select this affection because in other diseases the chemical examination of inflammatory products is very difficult, partly in consequence of the impossibility of procuring more than very small quantities, partly because they can be obtained so seldom in a pure and unmixed state. But the exudation of pleurisy, from the nature of its receptacle, approaches nearer to this condition of purity than would other exudations and infiltrations, where they are mingled with a variety of tissues by the changes in which they themselves would be apt to suffer change.

CASE I.—A man is attacked with pleurisy, and goes through all the regular phases of the disease. During the attack the chlorides are diminished or disappear in the urine. Exudation takes place, accompanied with an amelioration in the inflammatory symptoms.

The exudation is absorbed, and the chlorides reappear in the urine. Or, again, a man is attacked with pleurisy. The chlorides have disappeared from the urine. The man is tapped, and the effusion is found to contain in every 1000 parts 7.5 parts of chloride of sodium alone, while the blood contains normally only 4.2 parts: the whole amount of fixed salts being, according to Simon, in fluid obtained by paracentesis thoracis, 9.5 parts in 1000.

CASE II.—Pneumonia. A man has an undoubted attack of pneumonia. The chlorides disappear entirely from the urine. Convalescence, with reabsorption, takes place, and the chlorides reappear in the urine—or the man dies in the height of the disease. The chlorides were absent in the urine. At the autopsy, a general infiltration is found to have taken place into the tissue of the lung, and the salts in the blood, as in all violent inflammation, are found to be much diminished, while they are found in greater quantity in the sputa.

"In malignant cholera the excessive drain tells most on the fluid part of the blood, and hence that remaining in the vessels is thick and tar-like; hence, also, the extraordinary though temporary effect of injecting *saline solutions*, which return to the blood the material effused from it and revive all the functions that were well nigh extinct. Doubtless if the intestinal discharges could be arrested the effects would be permanent, but as it is, their effect is soon exhausted." If we, with the Germans, consider cholera to be an inflammatory disease, and in this the same metamorphosis of tissue to have taken place, the same consumption of the organic and deposit of the saline materials to have occurred as in other inflammations, we can easily understand why the exudation, occurring as it does, over such an extent of membrane, should be so excessive, and the drain on the system so great, the blood so thick and tar-like.

Many more instances of the same effect, taking place in other than the above-mentioned diseases, might be brought forward here, such as in peritonitis, in meningitis, and in pericarditis, &c. But the limits of this article will not permit their insertion here.

But it may be said that rheumatism is an inflammatory disease, and that the same general phenomena must characterize this as other inflammatory processes; that there would be the same metamorphoses of tissue, the same preponderance of saline material, and if there were, there would also be, according to the physical law laid down, an exudation, and if this exudation did take place there should be a decrease of the chlorides in the urine. Now the exudation in rheumatism is comparatively scanty, and although there is some diminution in the salts in the urine, they are not nearly so much diminished in this as in other inflammatory diseases. This seems at first sight to be at variance with the views brought forward, but in reality is confirmatory of them, as we shall see if we consider that rheumatism generally attacks the joints, where the tissues, instead of being

spongy or yielding, are compact and firmly bound down by tendons and fasciæ, which by their pressure on the vessels greatly impede transudation. And we can easily understand that the inflammation, although confined in extent, might be exceedingly violent and painful, and the consumption of material at that spot great, while the supply of new material, from the pressure exerted on the vessels which should provide that part, would be limited; and the accumulation of the chlorides at this spot and their decrease in the urine, not so strongly marked here as they would be where the inflamed part was a serous sac, where the morbid action could have full sway, where the vessels ramify over a large extent of membrane, and where there is nothing to impede but everything to favor exosmosis—as, for example, in pleurisy, peritonitis, meningitis, &c., or in the spongy tissue of the lungs, or the yielding ones of the brain. But when we have pericarditis associated with and dependent on rheumatism, we have the inflammatory process extending over a comparatively large surface. In this case, where the process of waste and repair is not interfered with, the consumption of the organic matter untrammelled, the residue of the inorganic unaffected, and the exudation unimpeded by pressure on the ramifying vessels, we not only have the effusion, but also the accompanying diminution of the salts in the urine—as in the case of Albert Ford, now at the Mass. Gen. Hospital, in whose urine only the slightest trace of the chlorides was detected.

In the foregoing remarks perhaps sufficient distinction has not been drawn between exudation and simple transudation. Reference has been made solely to the exudation which is the result of the inflammatory process, not at all to that of simple transudation dependent on a weakened and relaxed state of the capillaries—for in the latter process the chlorides are not diminished in the urine, while according to Lehmann they are even increased in the blood. No allusion has been made to the exudation resulting from the inflammatory process known by the indefinite and erroneous name of "lymph," as this is considered by the writer to be a healthy, not a morbid action—a process of repair for the purpose of replacing the tissue destroyed, since under favorable circumstances this is capable of organization, though this, like the other tissues, should the inflammatory action continue, can be consumed or destroyed, and then the same result will follow here as that mentioned as occurring in the preceding remarks.

How far exudation is the result of inflammation and not a part of it; and how far it is dependent on the saline ingredients in the economy, we have by the above arguments and examples tried to prove. It would be useless to cite any more, for if there is any truth in the above remarks these will be enough to prove it; if there is no truth in them, then the fewer examples to prove an absurdity the better.

MENINGITIS.

BY PETER D. WALSH, M.D.

[Communicated for the Boston Medical and Surgical Journal.]

MESSRS. EDITORS,—Having read with interest many articles entitled "Cerebro-Spinal Meningitis" in the Boston and Philadelphia Medical and Surgical Journals, I propose to submit the following case with its complications, taken from rough notes from day to day.

James Bresnan, aged two and a half years, always delicate, though well cared for, has had from time to time slight inflammation of the cervical glands, but seemed well at the time of his fatal attack.

On the 28th of March he fell from his bed, a distance of three feet, to the floor, on his face and forehead, leaving a slight scratch on his nose, but did not complain at the time.

On 29th, at 5, P.M., he fell into "a stupid fit," as the parents described it. I saw him at 7, P.M. He was lying on the bed; refused to answer questions; there was great stupor, and indifference to all surrounding objects; made no complaints in any way; skin dry and hot, face flushed, head and scalp of burning temperature; eyes open and staring; pupils fixed; breathing laborious; temporal arteries and jugular veins throbbing; pulse 140, strong.

Treatment.—Stood him in a warm bath; sponged him over briskly for fifteen minutes; cold applied to the head at the same time. Calomel, gr. viii., in two powders, to be given at intervals of four hours. Spt. nit. dulcis, twenty drops; fluid ext. digitalis, four drops; syr. aurantii, one drachm; and one-eighth of a grain of antimony every three hours until morning. Cold sponging to the head continued.

30th.—Saw him at 9, A.M. Has had two dejections; urinated freely; skin bathed with sweat; flush of face diminished; head and scalp cool; pupils more contracted and less staring; lying on the bed quite motionless; stupor continued, declined to answer questions; tongue coated and white; pulse 125, and small; refused to take drinks. From his great prostration I ordered the following:—Aq. camphoræ, minth. pip., syr. aromat., rhei., aa half drachm; spts. ammoniæ aromat., ten drops; quinine, a sixth of a grain; every two hours. Gum Arabic for drink; continue the cold to the head. Saw him at 5, P.M. Took his medicine; had great jactitation; head and scalp dry and burning; face flushed and glossy; body warm; eyes fixed and staring; pupils contracted; lower limbs flexed; tongue white and coated; temporal arteries and jugular veins throbbing; pulse 135, and bounding. Ordered a leech to each temple, to let them bleed freely; a large teaspoonful of castor oil; mustard poultice to nape of neck; to continue the cold sponging to head.

31st, 9, A.M.—Had a comfortable night; had one dejection; uri-

nated freely; took his drinks; answered questions, and was cheerful. Skin moist; head cool; flush of face diminished; tongue moist; pulse 100, and regular. Ordered hyd. cum. creta, gr. five, half in the forenoon and half at night; to continue sponging to head. Milk and water as drink.

At 7, P.M., was sent for; looked haggard and distressed, writhing with pain; passed no water for the six preceding hours. To be seated for fifteen minutes in a warm bath; fluid extract senna, one drachm, and the following diuretic—spt. nit. dulcis, twenty drops; fluid ext. hyoscyamus, ten drops; fluid ext. digitalis, three drops; syr. aurantii, one drachm; carb. sodæ, grs. six; every two hours in sweetened water.

April 1st, 9, A.M.—Took his medicine; had one dejection; made no urine; strained and wanted to sit continually on the chamber; groaning with pain; great nervous agitation; twitching of head and hands; thumbs clinched; lower extremities flexed; had no sleep; grasping at imaginary objects, and picking the bed-clothes; eyes dull and heavy; head cool; skin moist; considerable stiffness of neck, and drawn to the left side; whined when touched about the neck; pulse 100. Examined the chamber: it contained two tablespoonsful of urine filled with white lithates.

Ordered him to sit in a warm bath for ten minutes; flannels wrung out of warm rum well diluted, and water to neck. To continue his diuretic. At 9, P.M., father of the child came to me and said he was totally out of his mind, wanting to jump out of bed. Ordered three grains of Dover's powder.

2d, A.M.—Had a good night, and rested well; urine more free, with less pain, but filled with lithates; head cool; skin moist; complained of soreness of neck; pulse 98, and regular. Dover's powder, in two-and-a-half-grain doses, morning, noon and night. Diuretic to be continued. Flax-seed tea as drink. Warm fomentations to kidneys, bowels and neck. At 7, P.M., very comfortable. Urine abundant; lithates, or red gravel, appeared in small quantities.

3d, 9, A.M.—Made water freely, gravel almost disappeared; great nervous agitation—head and hands twitching, thumbs half clenched, with opisthotonos; lower limbs flexible; refused to take drinks, from difficulty in swallowing; pulse 130; tongue more clean and red. Ordered mercurial ointment, one drachm, to be rubbed in, morning and evening. Cotton flannels, saturated with warm hog's lard, over ointment.

I considered at this stage that the case was hopeless. My opinion being asked, I gave it freely, stating there were very little hopes of his recovery.

4th.—I called, but was informed that he was in care of another physician. The case being an interesting one, I was, however, resolved not to lose sight of it; hence I made an occasional visit, without invitation or interference.

The attending physician at this time called it "*the new disease of the South*." I suppose he meant cerebro-spinal meningitis. He continued his visits for some time, making hopeful promises, but he, too, was doomed to disappointment.

A seventh and last was called in, who made several visits, with no better success. I regret I cannot give the treatment of these gentlemen, as it would make the case more interesting.

The little patient continued to sink gradually, appearing to suffer but little. He took his drinks very sparingly, and on the forty-fourth day of his illness he lost his speech, had involuntary discharges, and opisthotonos still continued. On the fifty-fourth day congestion of the lungs set in, with partial loss of sight, and on the fifty-eighth day death closed the scene.

I considered this, Messrs. Editors, an aggravated case of genuine *meningitis*, as described by Copland, West, J. B. S. Jackson, and many others, and treated it accordingly. As the child was not exposed to the mephitic exhalations in the malarious regions of the South—so graphically described some time past in this JOURNAL, by one of our army surgeons there—I cannot see how or why it should be called "*the new disease of the South*." What abnormal features did it present to justify the new-fangled nomenclature, and in what measure, symptoms, or signs, did it differ from the old type, and so don the garb of that remote, occult and *mysterious stranger*? It would confer a favor on your correspondent, and benefit, in his opinion, the profession, were his learned and respected *confrere*, above alluded to, to condescend thus publicly to give us the pathognomonic symptoms, or signs, whereby he was—that we may be—able to distinguish and discriminate between *the old Northern* and *the new Southern disease*, and so draw a line of demarcation which would clearly and unerringly point the way to a correct and accurate diagnosis—with the appropriate, *new* treatment of the nondescript *new* disease.

THE TOOT-POISON OF NEW ZEALAND.

By W. LAUDER LINDSAY, M.D. AND F.R.S. EDIN., F.L.S., &c.

DURING a tour through the New Zealand provinces in 1861-62, the writer was struck with the abundant evidences which everywhere presented themselves of the ravages produced among the flocks and herds of the settlers by the *Toot-plant*, one of the most common indigenous shrubs of those islands. In many cases of losses by individual settlers brought under his notice, the amount from this source alone had been from twenty-five to seventy-five per cent. In Otago particularly were such losses felt during the height of the gold mania, from July to December, 1861; the traffic between Dunedin and Tuapeka gold-fields requiring the service of large numbers of bul-

locks, a great proportion were lost by Toot-poisoning. In colonies which as yet have depended for their prosperity almost solely on pastoral enterprise, such losses form a material barrier to prosperity; and the concurrent testimony of the colonists in every part of New Zealand proves the great desirability of determining the nature of the Toot-poison, the laws of its action on man and the lower animals, and its appropriate antidotes or modes of treatment. With a view to assist in the attainment of these aims, the writer has made notes, on the spot, of a large number of instances of the poisonous or fatal action of the plant on man—adults as well as children—and the lower animals, and had brought specimens home for chemical examination. The chief results of his investigations may be thus stated:—

1. The Toot-poison belongs to the class of *Narcotic-irritants*.

a. Its action on man includes the following symptoms:—coma, with or without delirium; sometimes great muscular excitement or convulsions, the details differing in different individuals; during convalescence, loss of memory, with or without vertigo.

b. In cattle and sheep, they include vertigo, stupor, delirium and convulsions; curious staggerings and gyrations; frantic kicking and racing or coursing; tremors.

2. The poisonous portion of the plant,

a. To man, is generally the *seed*, which is contained in a beautiful, dark purple, luscious berry, resembling the blackberry, which clusters closely in rich pendant racemes, and which is most tempting to children; occasionally the young *shoots* of the plant, as it grows up in spring.

b. To cattle and sheep, in almost all cases, is the young *shoot*, which is tender, and succulent, resembling in appearance and taste the similar state of asparagus.

3. The following *peculiarities* exist in regard to the action of the Toot-poison:—

a. A predisposition must exist, such predisposition being produced in cattle and sheep by some of the following conditions or circumstances:—The animal is *not habituated* to the use of the plant; it suddenly makes a large meal thereof after long fasting, or long feeding on drier and less palatable materials, or after exhaustion by hard labor, or hot, dry weather. From some such cause the digestive system is deranged, and is susceptible of more serious disorder from the ingestion of food to which the animal is, at the time, unaccustomed. Hence Toot-poisoning frequently occurs in animals which have just been landed from a long and fatiguing sea-voyage, during which they have been underfed or starved, to whom the young Toot-shoots present the most juicy, fresh, pleasant diet.

b. On the other hand, the same kind of animals, *habituated* to the use of the Toot-plant, not only do not suffer at all, but for them it is regarded as quite equal in value to, and as safe as, clover as a

pasture food. It is an equal favorite with cattle and sheep, whether they have been habituated or not.

c. The predisposition in man is probably produced by analogous conditions depressing the tone of his nervous and digestive systems, or directly deranging them. *Children* are affected out of all proportion to *adults*.

d. Adults who have suffered from the poisonous action of Toot under certain circumstances have been exempt from such action under certain others—the same parts of the plant having been used, and apparently in the same way, in both sets of instances. Moreover, the Toot-berries enjoy, both among the Maoris and colonists, an enviable notoriety on account of the harmless and agreeable wine and jellies they are capable of producing, the former whereof especially has long been greatly prized. The *seeds*, however, in these cases probably do not enter into the composition of the said wine and jellies.

4. The current *remedies* for Toot-poisoning among the settlers are, in regard to—

a. Cattle and sheep—mainly bleeding, by slashing the ears and tail. Belladonna has been variously tried, and favorably reported on; by others, stimulants are regarded as specifics (carbonate of ammonia, brandy, or a mixture of gin and turpentine, locally known as "Drench"). Whatever be the nature of the remedy, there is no difference of opinion as to the necessity for the promptest treatment, since, at a certain stage of the action of the poison, *all* remedies appear equally inefficacious.

b. In man, the nature of the remedy is still more varied, though emetics and stimulants seem the most rational of those usually had recourse to.

5. The *Toot*- or *Tutu*-plant is the *Coriaria ruscifolia*, L. (the *C. sarmentosa*, Forst). The plant is variously designated by Maoris and settlers in different parts of the New Zealand islands; and this of itself indicates how familiar it is, and how abundantly and widely distributed. The genus *Coriaria* is a small one, and, if not belonging to a sub-division of the Natural Order *Ochnaceæ*, probably represents a separate Order closely allied thereto and to the *Rutaceæ*. The most distinguished botanists, however, are at issue as to its precise place and alliances in the vegetable system. They are in similar dubiety as to the *species* of the genus, and the *varieties* of the species *C. ruscifolia*, L. In New Zealand there appears to be at least three *Coriarias*, which some botanists regard as mere varieties of *C. ruscifolia*, L., and others consider separate species. The writer had made, in July, 1862, an examination of all the species of the genus *Coriaria* contained in the Hookerian and Benthonian Collections at Kew, the result whereof was a strong conviction of the necessity for a critical revision of the whole genus, throughout all its species, wherever distributed. The writer considers the specific

names of the Toot-plant (both *ruscifolia* and *sarmentosa*) objectionable, as not truly applicable or descriptive; and proposes the specific term *C. tutu*, the Maori name of the plant, as more convenient to indicate the type of the species, leaving such terms as *ruscifolia*, *thymifolia* and *sarmentosa*, to represent varieties or other species, as a subsequent critical examination of the genus may render necessary or desirable.

In contrast to, and in connection with the toxic action of *C. ruscifolia*, the writer may remark on the better-known poisonous properties of *C. myrtifolia*, familiar as an adulterant of senna, and on those of other species of the genus *Coriaria*. He announces his belief that the whole genus *Coriaria* must be considered endowed with poisonous properties, probably of the narcotico-irritant class, and that, as such (especially in reference to the extent and importance of the economic losses caused by such species as Toot), it is eminently deserving of thorough scientific investigation.

Under this head he may point out the fact that—

a. While certain animals seem to be themselves exempt from, or insusceptible to, the action of the poison, they may, by feeding upon certain species, or certain parts of some species of *Coriaria*, and thereby assimilating or secreting the contained poison in their tissues, communicate poisonous effects, or become poisons, to man or the lower animals, to which they (the animals first mentioned) have become articles of diet. He would cite a recent instance in connection with *C. myrtifolia*, in which several persons near Toulouse were poisoned by a dish of snails which had been fattened on its leaves and shoots.

b. That Royle, in reference to the fruit of *C. napelensis*, Peschier, of Geneva, in regard to *C. myrtifolia*, and other authorities in regard to other species of *Coriaria*, have published instances of their harmless or even beneficial effects, under certain circumstances, on man or the lower animals. Such conflicting statements would appear to indicate that there are peculiarities in the action of the poisonous principles of all the *Coriarias*, or discrepancies in the records of instances of the said action, which discrepancies or peculiarities demand reconciliation or explanation at the hands of competent scientific experts.—*Pharm. Journ., Lond.*, February, 1864, from *Proceedings of the British Association*.

Reports of Medical Societies.

EXTRACTS FROM THE RECORDS OF THE BOSTON SOCIETY FOR MEDICAL IMPROVEMENT. BY FRANCIS MINOT, M.D., SECRETARY.

MAY 9th.—*Spontaneous Hemorrhage in a New-born Child*.—Dr. MINOT reported the case.

The patient was a female child, born April 15th. The mother was

delivered with forceps, on account of inefficient pains, after a labor of 26 hours, the liquor amnii having been discharged six days previously. The child was large and vigorous, weighing nine pounds. From the time of its birth it frequently vomited a brownish liquid, until the afternoon of the 18th, when it began to bleed freely from a slight scratch, made by the forceps, on the frontal bone. At the same time it vomited blood freely, and ecchymotic spots appeared on the tongue and roof of the mouth. A large spot occupied the right temple and covered the side of the neck. Others appeared on the elbows and malleoli. The bowels were free, the stools of natural color. Urine natural. No jaundice, though a slight straw-colored tint appeared on the skin. The child moaned and seemed to be distressed when awake, but slept a great deal. There was no hæmorrhage from the navel.

Perchloride of iron was applied to the bleeding spot, and permanently arrested the flow. A weak solution of the same was given internally every two hours, with wine whey, and injections of milk. The child nursed freely throughout. The symptoms were immediately arrested, and the child gradually recovered. The cord separated on the 6th day without hæmorrhage.

An interesting fact in relation to this case is, that a cousin of the patient by the father's side (also a female) died soon after birth from umbilical hæmorrhage. Although there happened to be no bleeding from the navel in this case, it must evidently be classed under the head of "umbilical hæmorrhage," the chief characteristic of which is a disposition to spontaneous hæmorrhage from various parts, in new-born infants. This case resembles one formerly reported to the Society by Dr. Coale, in which, also, there was no bleeding from the umbilicus; the child was apparently saved by the exhibition of dilute sulphuric acid.

MAY 9th.—*Symptoms of Cerebro-Spinal Meningitis; doubtful appearances of Disease of the Pia Mater, of the Brain and Spinal Cord.*—Dr. ELLIS reported the case.

A child, 7 years of age, was attacked eleven weeks before death with fever and pain in the frontal region. Ten days after the commencement of the disease, the head was drawn strongly backwards, and opisthotonos became so marked that the shoulders did not touch the bed. This continued until three weeks before death. The pupils were dilated from the commencement until the last day, when they became contracted. Though delirious, the child could always be roused. The pulse at the outset was extremely rapid, hard, full and strong, and so continued for more than six weeks, when it became nearly natural. No nausea nor other symptoms referable to the digestive organs. No chills. No petechiæ until towards the close, and then only to a slight extent. The above were the principal symptoms, obtained from Dr. Holmes, of Milton, who had charge of the patient. There were no special changes towards the close, and death seemed to result from exhaustion.

On examination of the head, the arachnoid was found dry, and the convolutions somewhat flattened. The lateral ventricles contained from four to six ounces of clear serum. The membranes of the base had a slightly opaque appearance, and were somewhat infiltrated, but there were no miliary granulations nor other evidences of disease. The arachnoid and pia mater of the spinal cord were, perhaps, opaque,

and somewhat peculiar, but neither the changes here nor in the membranes of the brain would have attracted special attention, had it not been for the epidemic of cerebro-spinal meningitis prevailing at the time. The thoracic and abdominal viscera were not examined.

The case was regarded as interesting, inasmuch as morbid appearances not unfrequently met with were accompanied by symptoms which pointed to a lesion of the membranes of the brain and spinal cord, and yet the latter could not be clearly shown to exist. May it not indicate that the symptoms of ordinary disease can be modified by the prevailing epidemic influence, although peculiar lesions are not satisfactorily made out?

MAY 23d.—*Croup; Tracheotomy; Recovery.*—Dr. CABOT reported the following case.

"F. S., rather a delicate boy, 2 years and 6 months old, had been somewhat ailing for a week on Sept. 7th, and was slightly hoarse. I saw him on the 8th, found him slightly hoarse and with a pulse a little quick. On looking into his throat, found the posterior fauces covered with false membrane; none in front of anterior pillars of palate. Ordered chlorate of potash, generally and locally, generous diet, and stimulants. His appetite was quite good until the 10th, when it began to fall off. The false membrane had entirely disappeared from the throat by the 10th, but the hoarseness had increased, and the breathing became worse and worse until the 11th, when it had become so labored as to cause lividity on several occasions. On the 12th, the pulse had risen to 120 or 130, somewhat intermittent; respiration very labored, and evidently suffocation was imminent. I desired a consultation, and Dr. Buckingham met me at 10, P.M. He agreed with me that tracheotomy afforded the only chance, and I accordingly opened the trachea. There was no bleeding, and a few minutes after the operation two large pieces of false membrane were thrown up. From that time but very small bits were ever seen, and the child went on steadily to recovery. The tubes were removed on the 17th, five days after the operation, and the child is now (23d) well, excepting a slight cough.

"The points of special interest are:—1st. The extent of false membrane in the fauces, allying the case to diphtheria. 2d. Severity of croup symptoms, with so limited a deposit of false membrane in the trachea. 3d. Rapidity of recovery; and, 4th. The absence of all perturbing, depressing or narcotic treatment, from first to last. To which last, or rather to the pursuance of a precisely opposite plan, viz., sustaining and stimulating, I attribute in great degree the favorable result of the case."

THE BOSTON MEDICAL AND SURGICAL JOURNAL.

BOSTON: THURSDAY, JUNE 16, 1864.

ANNUAL MEETING OF THE AMERICAN MEDICAL ASSOCIATION.—The annual session of the American Medical Association was held in New York during the past week. The delegates assembled on Tuesday,

and filled Irving Hall, which had been selected as the place of meeting. The profession was well represented by prominent members from the loyal States, who seem to have produced a very favorable impression upon the popular mind, judging by newspaper reports, for the gravity and dignity of their bearing. The meeting was opened in due form by Dr. Alden March, the retiring President. His address is spoken of as a most able and eloquent effort. The usual introductory business was transacted, and a nominating committee of twenty-one reported the following list of officers for the year:—For *President*, Dr. N. S. Davis, of Illinois. *Vice Presidents*, Dr. William H. Mussey, Ohio; Dr. Worthington Hooker, Conn.; Dr. William Wheelan, District of Columbia; Dr. F. E. B. Hintze, Maryland. *Treasurer*, Dr. Caspar Wister, Pa. *Secretary*, Dr. G. Furman, New York.

It was voted that the next meeting of the Association be held in Boston.

Considerable discussion took place with regard to the report of the Committee of Nomination, which finally resulted in the election of the entire list presented. The President's address was followed by a report from the Committee of Arrangements and other matters of incidental business, of which we hope to give a fuller report hereafter.

On the second and third days about half of the time of the meetings appears to have been occupied by merely business matters. A number of papers were read, and the several Standing Committees appointed for the next year. Friday, the last day of the session, was devoted to visiting the various hospitals and City Institutions in and about New York. The delegates were hospitably entertained at Blackwell's Island, and a steamboat trip gave them an opportunity of enjoying the picturesque scenery in the neighborhood of the city.

We hope in our next number to give a fuller account of this meeting than the meagre skeleton above. We have been disappointed in receiving the report we had looked for, and are unwilling to trust the daily newspapers for lists of committees and matters of a purely professional character, and must therefore defer their publication to another occasion.

INTERNAL ADMINISTRATION OF BELLADONNA IN CASES OF SEVERE BURN.—Experimental physiologists have recommended belladonna for use in the treatment of burns, in the belief that it diminishes that state of the nervous functions under which reflex inflammations are likely to be originated. They assert, on the other hand, that of all remedies opium is the one most powerful in increasing this peculiar state, and that it ought consequently to be avoided. In clinical practice, however, we believe that this opinion is wholly disregarded, and that opium is the form of anodyne most commonly resorted to in these cases. Yet it is generally suspected that the causes of death after burns are, in a majority of instances, connected with reflex inflammations, *e. g.*, ulcers of the intestine, pneumonia, &c. In a series of cases recently under Mr. Hutchinson's care in the London Hospital, the belladonna treatment has been tried. In some remarks at the bedside of a patient, the other day, Mr. Hutchinson stated that he considered the general results to have been fairly satisfactory. He adverted to the extreme difficulty of forming a trustworthy conclusion on such a matter, since these cases are, in their nature, never stationary,

but always tend either to improvement or the reverse, and often with great rapidity. If, therefore, the remedy were commenced when the patient was very ill, it might chance to be just at the time when improvement was about to set in; and if, on the other hand, the patient got worse, it might fairly be alleged that the remedy was used too late. If, on the other hand, we should give it in cases in which, as yet, no serious symptoms had appeared, we might again be much led astray, since a great majority of burn cases do well without any special plan of medication. Mr. Hutchinson stated that the cases in which the remedy had seemed to be most useful, were those of children in whom general febrile symptoms, attended with restlessness, loss of appetite, &c., had set in without any local complications. In several of these, there could be no mistake that the feverish state had passed away quickly and very satisfactorily under the use of belladonna. In no cases had he witnessed any ill results. If the burn itself was very painful, and the patient unable to get sleep on account of the pain, then the belladonna seemed comparatively inefficacious to procure ease, and morphia was far more efficient. As a rule, no opium had been given to the cases treated by belladonna; but in a few, and those chiefly in adults, it had been found requisite to give an occasional night dose. Possibly more benefit might have been obtained had the administration of the belladonna been pushed to larger doses. The usual dose given had been a third of a grain three times a day. In speaking of the less frequent results of burns, Mr. Hutchinson mentioned a recent case in which acute inflammation of one hip-joint, followed rapidly by dislocation, had occurred in a child who had been severely burnt on the arm and chest. He was in doubt whether to regard it as a reflex inflammation, or as a consequence of pyæmia.—*London Medical Times and Gazette.*

BIRTHS AND DEATHS IN LONDON.—The last quarter of 1863 was remarkable for the small number of births and deaths in the city of London. That of births was the smallest on record, for it reached only 668, the average for the corresponding quarter of the last ten years being 807. The deaths also were below the average in the proportion of 699 to 749. The number of deaths, too, in the quarter, had been greater than the births, an occurrence scarcely known except in the cholera year, 1854, when there were 939 deaths to 789 births.—*Lond. Lancet.*

RED BLOOD IN THE VEINS.—Dr. Brown-Séquard arrives at the following conclusions regarding the color of venous blood. 1. The blood is of a less deep color in the veins of limbs paralyzed by section of their nerves or by destruction of a part of the spinal cord, than in the veins of sound limbs. 2. The diminished depth of color in the veins of paralyzed limbs is due, at least in part, to the state of inaction of the muscles. 3. Paralysis of the bloodvessels may also produce a reddish color in the venous blood. 4. It is especially through their influence in exciting muscular contraction, that the nerves and galvanism increase the intensity of the dark color in venous blood.—*Canada Lancet, from British Medical Journal.*

MORTALITY OF PROVIDENCE, R. I.—There were 89 deaths in Providence during the month of May. The mortality was no more than the average, increased for the increase of population. There were 14 deaths from scarlet fever, a greater number than in any month since April, 1858. There were also 5 deaths from diphtheria, 2 from whooping cough, 1 from measles, and 3 from croup, making 25 deaths from these five diseases. During the first five months of the present year, there have been 33 deaths from scarlatina, showing that the disease is again on the increase. Smallpox still continues in the city, mostly in the modified form, usually called varioloid. There has not been a death from smallpox, in Providence, since March 31, 1862.

EFFECTS OF SUGAR ON TEETH.—"The action of sugar upon the teeth is an undecided question. Popular belief is to the effect that the use of much sugar, and particularly of candies and sweetmeats, is a common cause of dental caries. Drs. Paolo, Mantegazza, and Labus, of the University of Pavia, have recently undertaken a series of experiments to settle the matter. A translation of their paper may be found in the February number of the *British Journal of Dental Science*. The chief conclusions to which these investigators have come are—1st, that sugar (as sugar) does not exercise any chemical action upon the teeth, and that it does not predispose to caries; 2dly, that sugar only affects the teeth when it has undergone the acetic or lactic fermentation."—*Lancet*.

THE MISSISSIPPI VALLEY DENTAL ASSOCIATION have offered a prize of \$100 for the best essay on Anæsthetics, to be approved by a Committee of the Association; the copyright to belong to the Association.

MR. EDWARD PARRISH, a pharmacist of Philadelphia, has been elected Professor of Materia Medica in the Philadelphia College of Pharmacy, in place of Robert P. Thomas, M.D., deceased.

STEPHEN G. HUBBARD, M.D., of New Haven, has been elected Professor of Obstetrics in Yale College to fill the vacancy occasioned by the resignation of Dr. P. A. Jewett.

VITAL STATISTICS OF BOSTON.
FOR THE WEEK ENDING SATURDAY, JUNE 11th, 1864.

DEATHS.

	<i>Males.</i>	<i>Females.</i>	<i>Total.</i>
Deaths during the week	62	35	97
Ave. mortality of corresponding weeks for ten years, 1853—1863,	34.0	32.5	66.5
Average corrected to increased population	60	60	73.21
Death of persons above 90	0	0	0

DIED.—At North Amherst, June 10th, suddenly, of apoplexy, Dr. Seth Fisk, probably the oldest practitioner in Hampshire County.—At Keene, N. H., June 8th, Dr. Daniel Adams, aged 90 years. Dr. Adams was the author of the *Scholar's Arithmetic* and other school books, and for a long time a resident of this city.

DEATHS IN BOSTON for the week ending Saturday noon, June 11th, 87. Males, 52—Females, 35.—Abscess, 1—accident, 3—alcoholism, 1—congestion of the brain, 1—disease of the brain, 4—inflammation of the brain, 2—bronchitis, 3—burns, 1—cholera infantum, 1—consumption, 13—convulsions, 2—croup, 5—debility, 2—diphtheria, 1—dropsy of the brain, 2—epilepsy, 1—erysipelas, 1—scarlet fever, 6—gastritis, 1—hæmorrhage, 3—disease of the heart, 3—infantile disease, 3—intemperance, 4—disease of the kidneys, 1—inflammation of the lungs, 3—marasmus, 1—measles, 1—paralysis, 3—premature birth, 3—rheumatism, 1—smallpox, 2—suicide, 1—syphilis, 1—tumor, 1—unknown, 5.

Under 5 years of age, 38—between 5 and 20 years, 9—between 20 and 40 years, 19—between 40 and 60 years, 12—above 60 years, 9. Born in the United States, 58—Ireland, 23—other places, 6.